

### THE FUNCTIONS OF TECHNICAL COLLEGES.<sup>1</sup>

IN glancing over the early history of mechanics' institutes in this country, it is not at all clear that their founders believed that the maintenance of the position of Britain as an industrial nation was likely to depend in any direct way on the more scientific education of the working classes. The industrial position of the nation was still unchallenged, British labour was still as efficient as that of any other country, the organisers of industry were second to none in shrewdness and enterprise, and the rising suns of America and Germany were still below the industrial horizon. While the exact date at which these orbs arose may be uncertain, there can be no doubt that early in the last quarter of the nineteenth century they were already well above the horizon, and were beginning to cast sharp shadows across the industrial fields of Great Britain. Long before these signs had become obvious to the commercial and industrial classes, a number of far-seeing men, some of them industrial leaders, but the majority men of science or education, had raised the cry of more extended and popular education in science. Thanks to their advocacy this policy of reform began to make itself felt, and before the final decades of the century were spent the modern technical education movement was well under way.

Even if I were sufficiently informed to sketch for you the history of this movement, it would be superfluous for me to do so, as you are already familiar with the various stages in its development. My purpose in recalling the past was rather to help me to present to you the situation to-day, as it appears to me, not as a professed educationist, but as one who has for more than a generation been closely associated with industry and with the application of scientific methods to its development. I am fully conscious that my own views on the subject of technical education are still in process of crystallisation, and I cannot do more than ask you to accept me among your number as a student who desires to cooperate with you in advancing the great cause you have at heart.

These yearly gatherings may be regarded as halting places on our journey, from which we may look backwards over the various routes along which we have been travelling, and forwards into the country which still stretches ahead. The particular route on which it has been my lot to travel has not been wanting in variety and interest for the traveller, but as I have not yet reached the age at which my personal reminiscences could have any claim on your indulgent attention, I only refer to the journey in these general terms, and mainly because it has been made over one of the less frequented routes. As some of the hilly parts of the route happened by good fortune to be traversed in stimulating company and under favourable conditions of the atmosphere, the views which were then absorbed have left many vivid impressions, some of which have no doubt influenced me in my choice of a subject on which to address you.

It appears to me that the time has arrived when we may profitably review the position of the technical institutions in their more direct relations to the industries of the country. If we are possessed by the belief that the industrial future of the nation must largely depend on the spread of education in science and in the application of its laws to the affairs of daily life, then we cannot escape from the conclusion that it is our particular duty to see to it that we are taking a leading part in this vitally important work. This is the task which has been laid upon us by our founders and supporters, public and private. It is also the task to which we have committed ourselves from the moment when we began to enrol students in our classes. These students have come to us in the belief that we in our superior wisdom can guide and train them for the more assured places in the world of industry, so that our obligations to them also compel us to associate ourselves more and more closely with the industrial interests. It is hardly possible to over-estimate the importance of the task we have undertaken, and the more we appreciate its magnitude the more likely shall we

be to cultivate only the broadest and most fully informed views of the lines on which we may hope to discharge it worthily.

While we must realise that this is essentially the task which is now laid upon the technical institutions, and that it devolves upon these bodies to take the lead in stating the problems which are involved and in working towards their solution, we none the less gratefully recognise the pioneer work of the universities in the same fields. It behoves us, therefore, to walk hand in hand with those universities which have established within their own boundaries faculties of applied science, and to avail ourselves of their experience, not only in this special department, but also in other fields of professional training. For the universities, however, this problem is only one among the many with which they are called upon to deal, while for the technical institutions it is the central problem. The very singleness of our aim, therefore, ought to give a force and concentration to our efforts which should go far to ensure success of a kind which has never before been attained.

The training of men for the practice of the learned professions has always been largely in the hands of the universities, and one of the principles which has been evolved in the organisation of this training is of the deepest interest for us, as it has an important bearing on the work we are called upon to perform. This principle is that the final judgment as to the courses of study and preparation should rest mainly with practising members of the professions. I think I am right in saying that in the faculties of law, of medicine, and of theology, this has been recognised, and that throughout their courses of study and preparation the students are brought into contact with practising members of the profession for which they are qualifying. They have thus the opportunity of realising the practical bearing of their intellectual studies on the work of their profession, and the intellectual atmosphere around them is that peculiar to their profession. One result of this is that when the graduates in these faculties leave the university they already possess the instincts of their profession, and are proud to be classed among its members. They may be, and probably are, very inexperienced members, but the fact remains that they have been professionally trained. This means that the knowledge they have acquired has already been to some extent correlated to the work which they are expected to perform. They have been trained to state the practical problems of their profession in a scientific way, and to look for their solution through the methods of accurate and intelligent observation and reasoning.

This principle is equally recognised outside the universities in the training required for the newer professions. The professional bodies which regulate the admission to their membership of civil engineers, architects, accountants, and analytical chemists, all require that the education of the candidates shall be of a definitely professional character, and it is always supervised by practising members of the particular profession.

If the training in our institutions is to be modelled on the lines of the best professional standards, we shall have to secure the active cooperation of representative men from those industries for which we propose to train our students. With the help of these representatives we must organise courses of instruction, practical as well as theoretical. We must give to the practical side the same kind of reality as is found in the clinical teaching of medical students, and it must be made compulsory for all who desire to obtain the full diploma of the college. It ought, therefore, to be supervised by a joint committee of the board of studies and the representatives of the industries. If the colleges, with the cooperation of industrial representatives who are themselves employers, can in this way organise and supervise the practical side of their training, the education of the engineer, the electrician, and the chemist will be rendered homogeneous from beginning to end, and the diploma will then be as definite a guarantee of complete professional training as the medical degree now is. In both cases the experience which only results from practice has still to be won, but the professional training will enable its possessor to begin to make his experience through his own practice.

<sup>1</sup> Address delivered at the annual meeting of the Association of Technical Institutions on February 15 by Dr. George T. Beilby, F.R.S., president of the association.

You will perhaps say that this is a counsel of perfection. Well, even if it be so, I think it is worth while occasionally to indulge in such counsels. I will therefore ask you to follow me rather more closely into the question. Let us first consider what is the present position as regards the training of the class of students whom we are supposed to understand best, the engineers. In this matter our colleges have been satisfied to follow on the lines laid down by those universities which confer a degree in engineering science. This degree, like the diploma of our colleges, is granted without any reference to office or workshop training. Under the "Sandwich system" time is given for the students who choose to do so to obtain a certain amount of experience in outside offices or workshops during the intervals between the university terms, but there is no direct supervision of this work, it is not even compulsory, and any student with the necessary intellectual capacity can take his degree quite as well without as with it. Though the universities and colleges take no official cognisance of the fact, yet the students are given to understand that if they desire to qualify themselves for responsible posts in the engineering world they must serve either a full or a modified term of apprenticeship in some recognised office or workshop before, during, or after their college course. They must be prepared, therefore, to devote from six to eight years to obtaining the full training required for their profession. Even the longer of these periods is not too long, but we must admit that it is a fairly large slice out of the life of a man, so that it behoves us to make sure that it is used to the best advantage. If we analyse the total period of eight years, or ninety-six months, we shall find that from twenty to thirty months are spent in close study and examination work, eight to ten months in holidays, fifty-six to sixty-eight months in the workshop or office. I find it difficult to believe that this is an ideal distribution of the time; at any rate, it appears to me that we ought to be able to put ourselves into a position from which we may be free to discuss it in its various aspects and to modify it in an authoritative way if it seems right that we should do so. Under present conditions these young men come to us and in effect say, "We want your degree or diploma, but as we shall also have to spend a number of years as apprentices we cannot afford to give you more than three years, therefore be good enough to do the best you can for us in that time," and we certainly try to do our best in the circumstances; but the circumstances are rather unfortunate, for do we not too often find ourselves helpless to contend against the "examination bogey" which obtrudes itself at every turn? So much book and lecture work has to be overtaken in three short years that if we attempt to develop the intelligence of the students in any directions which do not lie directly in the line of the degree, they are at once unsympathetic or even obstructive. The students cannot afford to give themselves any time to develop their own thinking and reasoning powers, and yet the time spent at college or university ought to be the great intellectual opportunity of their lives. Not once, but many times, have I been shocked by the absolutely un-intellectual outlook of the bright and apparently capable young men who pass through our colleges. Now it appears to me that if these young men could come to us and say, "We know that we must give seven or eight years to preparing for our life's work, will you undertake to organise and supervise our training, practical as well as theoretical, for the whole period, and will you then give us a degree or diploma which will be a real mark of our professional training and fitness?" we could accept the larger responsibility with lighter hearts and with a hopefulness which we have no right to feel under present conditions.

Our larger institutions are in a unique position to deal with this matter in a courageous manner, for they hold a mandate directly from the people who are most deeply concerned in it. To put it at once on its broadest ground, the nation has a right to expect this from us. Some of the universities have given us a noble lead in our earlier development, but I am bold enough to think that we have outgrown that lead, and the sooner we recognise that fact the better it will be for those who are depending on us. Not only is public opinion on our side, but industrial

opinion is being rapidly permeated with more advanced views on the mutual relations of science and industry. The most practical result for us is that industrial leaders and manufacturers are beginning to give us their active sympathy and cooperation. This appears to me to be the real key to the situation.

Speaking for the college with which I am associated, I can say that this cooperation is an accomplished fact. It is now some years since the governors instituted a regular system of committees of management for the different departments of work. These committees are empowered to deal, not only with the purely business matters which arise in their departments, but also with questions of educational policy, and they act as the intermediaries between the board of studies and the governors. The board of governors itself is fairly representative of the leading industries of the district, but the departmental committees are made more directly representative by co-opting as members the heads of the leading manufacturing firms and professional men of acknowledged standing and reputation. The industrial leaders are now within the inner circle in the management, and can not only assure themselves as to the nature and quality of the educational work which is being done, but are able to exert a real influence upon it. For the students of the college the cooperation of the industrial leaders has a double advantage, for not only have they the assurance that their education is being conducted on lines approved by practical men, but they know also that these men are the representatives of the class which holds the key to the principal openings for their future employment.

By securing the cooperation of the industrial leaders we have taken an important step towards securing for our students the full professional training which seems to me so desirable. We have also made a beginning in developing an atmosphere of practicality in the college; but all the advantages of this union are not on the side of the college. Speaking as myself an industrial man, I can say that we also stand in much need of the kind of education which our close association with this work is admirably adapted to give us. Many of us have still no clearly defined ideas as to the way in which more scientific methods and more highly trained experts can be of advantage to our particular industries. Many who have the will to avail themselves of these helps are at a loss to understand in what way the new wine of modern technological training can be introduced into the old bottles of industrial tradition without disastrous consequences for both. If it is frankly admitted that both sides in the combination have much to learn, first from each other and later from their joint experiences, I am exceedingly hopeful that the way will be opened up for a very real advance in the scientific organisation of industry. As regards our trade classes, this principle of cooperation had to be admitted very early in the day. It was obvious that apprentices and learners could only be trained in craftsmanship by teachers who were themselves craftsmen. For the management of these departments committees have been formed which consist mainly of master craftsmen and employers. The trade employers have responded to our call, for they have found in these trade classes the modern substitute for, or supplement to, the old system of apprenticeship. We have in this instance an almost ideal fusion of the practical and theoretical sides of the training. The student passes so freely from workshop to college and from college to workshop that there need be no sharp line of demarcation between the two methods of obtaining knowledge. The soundness and practicality of his training in handicraft is assured, while on this foundation of craftsmanship we can build an equally secure superstructure of intellectual training suited to his needs. We can teach him to lay off his work with scientific method, and with a sound knowledge of the properties of the materials, and to conduct the various operations with a knowledge of the natural laws on which these operations depend.

The consideration of the system in force in the trade classes brings out more forcibly the weakness on the practical side of the training of engineers and chemists. The atmosphere of practicality which is so essential a feature in the one case is conspicuously wanting in the other; but



this consideration may well encourage us to hope that the combined system which works so admirably in the trade classes may lend itself in a modified form to the solution of the more complex problem of the practical training of the engineer and chemist.

The problem is certainly more complex, but from the industrial point of view it is really not more serious than that which has already been faced by the handicraft trades. If the manufacturers and industrial leaders can be brought to realise, as the master craftsmen have done, that it is our central purpose to educate our students of all classes in the best possible way for their future work in industry, then I feel assured that we shall gradually secure more and more of their active help and cooperation. Without this help it would obviously be impossible for us to organise the workshop or other practical training of our students, but with it the difficulties may easily be surmounted.

If we are to undertake the organisation of the practical part of the training of our students, the cooperation of the employers will be necessary (1) to keep us supplied with a sufficient number of posts for temporary apprentices or learners in their works, and (2) to enable us to keep some kind of supervision over the students during their training. Probably a visiting inspector would be required, whose duty it would be to keep in touch with the managers of the works in which the apprentices are placed. This officer would be invaluable in making all detailed arrangements between the managers and the college, and in arranging for the distribution and re-distribution of apprentices among the various works.

It is well to remember that in seeking for opportunities for practical training we are not necessarily restricted to engineering works. In connection with the various municipal enterprises, electric lighting and power works, gas, water, and sewage works, employment may be found if the heads of these departments can be induced to take the necessary trouble. We shall return to this question in considering the position as regards students who are preparing to take their place in chemical industry.

While the colleges would be deeply indebted to the manufacturers who would cooperate with them in this matter, we need not neglect to represent to these gentlemen that the advantages would not all be on one side. By the cooperation the whole system of the apprenticeship of educated young men would be put on a more businesslike footing, "slackers" and "loafers" would be quickly found out and dealt with or dismissed, and intelligent hard work would be encouraged. I am not blind to the fact that there will be difficulties to be got over and asperities to be smoothed before the arrangement can be got into thorough working order, but none of these need be formidable, and we must expect to encounter little troubles in making any important change of practice.

The training of chemists for industry is a subject which has been much discussed again during the past year. Early in 1908 a subcommittee of the governing body of the newly created Imperial College of Science and Technology made a report on the subject to that body, but as that report has not been published I shall refrain from making any remarks upon it. Some of the provincial sections of the Society of Chemical Industry have also organised discussions on the subject. The first of these took place at the University of Birmingham.

At the British Association meeting in Dublin, Prof. Stanley Kipping made this the subject of his presidential address to the chemistry section. This widespread discussion shows at least that there is a healthy interest in the subject in quite a number of quarters. It occurred to me that the best way to introduce the subject on this occasion would be by a brief narrative of the action taken by the Institute of Chemistry some three or four years ago. The institute is a professional body, and it exacts a very high standard of attainment both in science and in the professional application of chemistry. Its examinations are largely practical, and any chemist who has attained to the associateship must be recognised as fully competent to take charge of all the ordinary chemical work of the laboratory. The full qualification of fellowship can only be attained after the associate has produced satisfactory evidence that he has been in successful prac-

tice as a professional or industrial chemist for five years subsequent to his admission to the associateship. The fellowship is therefore a direct guarantee of professional competency.

Some years ago the council of the institute formulated a supplementary scheme for the granting to its associates and fellows a further certificate in chemical technology. This scheme was only formulated after an exhaustive inquiry had been made, more especially as to the views of those chemical manufacturers who were themselves chemists. A practically unanimous opinion was expressed by these gentlemen that an ordinary laboratory training, even of the very thorough kind exacted by the institute, was not of itself a sufficient preparation for those who intended to make a place for themselves in chemical industry. In proceeding to formulate a scheme, the committee did me the honour of taking as their starting point a syllabus of chemical engineering which had been laid before the Society of Chemical Industry by me while I was its president in 1899. This scheme was greatly improved under the free criticism and discussion to which it was subjected by the able and practical men outside as well as inside the committee, and the syllabus which now forms part of the regulations of the institute ought to be regarded by our colleges and universities as a very valuable and authoritative pronouncement on the nature and scope of the study of chemical technology. As this subject had previously been either ignored or hopelessly misunderstood by the great majority of chemical professors and teachers, I think we must agree that the institute has earned the gratitude of all technical institutions by having placed on record this clear and compact synopsis of the subject. I am glad to have this opportunity of directing the attention of the heads of our technical colleges to this matter, and to suggest that those who are sending up students for the associateship of the institute should encourage them to take in addition the supplementary certificate in chemical technology.

During the formulation of this scheme there was considerable discussion on the question of practical works' training for students of chemical technology. This is a question on which there has often been misunderstanding. It has too readily been assumed that the chemical manufacturer who declines to throw open his works to students on the same lines as the mechanical engineer does is necessarily narrow-minded and obstructive. He is told from time to time by various learned persons that his supposed secret operations are a mere delusion, which would at once be exploded and superseded by something infinitely better if he would throw his works and process open to the criticism of the bright young graduates from our universities, yet he obstinately refuses to unlock his doors. I cannot plead guilty to any lukewarmness where the application of science to industry is concerned, but I must confess that I have considerable sympathy with the point of view of the much-abused manufacturer. If he happens to be using a process the conditions of which have been worked out by himself and his staff at much expenditure of time and money, is it at all surprising that he should regard this experience as one of his most valuable assets? Yet, strangely enough, his rights over this asset are only protected by British law if he is in the fortunate position of being able to secure a patent and maintain it against all comers; but in very many cases the prospects of being able to obtain or to maintain a patent are so problematical that he does not care to risk everything upon them, especially as the publication of a patent at once informs his rivals exactly what he is doing. In Germany, on the other hand, though the protection of this kind of intangible property is far from complete, cases of piracy by employees or others can be dealt with under criminal law, and the employer is thus placed in a much stronger position to protect his property.

I quite concede that there are many chemical works which might be thrown open to expert inspection because in their operations there is nothing special to be divulged, and in works of this description there is no intrinsic reason why student apprentices should not be admitted. But the habit of secrecy has become instinctive with the chemical manufacturer, for he is well aware that, though at one time he may have nothing to lose by publicity, yet in the

quick changes which occur in this industry he may any day find himself developing the kind of experience which finally becomes a real asset.

From the chemical manufacturer I fear there is not much to be hoped for in the provision of practical experience for our students, but fortunately there is much valuable experience for the young chemist to be obtained outside the chemical works. For him, as for the young engineer, the various departments of municipal enterprise ought to be made available. There is no finer school for the chemical technologist than the gas works which are to be found in every city. In these works the problems of fuel combustion and utilisation can be practically studied, and, in addition, destructive distillation, the handling and purification of gases, and the recovery and separation of by-products. The gas industry is still overflowing with interesting problems, and at the present time various revolutionary changes are looming ahead at no great distance. The gas manager who does not wish to be left behind in the race would do well to organise an experimental department, and to call to his assistance a staff of intelligent young men from our colleges. It may safely be said that there are very few chemical works which could afford so excellent a training ground for the chemist as the gas works might supply.

In what has gone before it cannot be said that the importance of the practical and professional sides of our educational functions has been minimised; I may therefore without fear of misunderstanding on this point seek to spend the short time which remains in putting before you certain views on the place which pioneer work in science and technology may occupy in our colleges.

It has been seriously suggested in certain quarters that the technical colleges should limit their functions to the training of students and craftsmen in the more obviously utilitarian applications of science, and should leave to the universities the cultivation of the higher developments of science. I think you will agree with me that this suggestion is altogether wrong. It is based on a most inadequate conception of what the mutual relations of science and industry ought to be. The heavy emphasis which I have laid on the practical and professional aspects of our work was designed to prepare the way for an equally strong insistence on the still higher functions which are involved in our intimate relations with scientific industry. Our purpose may be single, but it cannot be narrow and restricted, for in its final expression it involves nothing less than this, that our colleges must become, not only centres of light and leading, but also makers of new knowledge. I have spoken of the necessity for the creation in our colleges of an atmosphere of practicality, but we must now, in addition to this, consider the creation of a yet rarer atmosphere of intellectual enterprise and inquiry. These two atmospheres are not incompatible; on the contrary, they ought to stand to each other as complement and supplement in the circle of our educational functions.

In the large number of students who are passing through our hands we have at our disposal an almost ideal gathering ground for the brightest and most intelligent young men from the middle and industrial classes. During their training we have the opportunity of subjecting them to a sifting process, by which they may be broadly separated into classes according to their different kinds and degrees of ability. During this process of sifting it would be surprising if we did not find a few men who are capable of developing into enthusiastic pioneers, a proportion of whom ought ultimately to find their way to the front as real leaders in science and industry. Clearly it is our duty to provide for these men an environment in which they may breathe the vitalising air of intellectual inquiry and enterprise. If we turn this duty round to its other side, we shall see that it is one and the same as our duty to industry, and therefore to the community, for every man whom we can find and inspire in this way will become a substantial asset to the nation as well as to industry.

I do not put forward the plea that research is a necessary and desirable element in the training of *all* students, for I am still unconvinced on this point. Indeed, I am under the impression that many of the less successful students and graduates in science whom I have met have

been seriously injured through having been encouraged in the idea that the cultivation of original research is the duty of every student of science. The real pioneering work will never be done by mediocre men. My claim for the recognition and cultivation of pioneering ability is not made in the interest of students at large, but for the sake of the men of exceptional capacity in this respect.

When we turn to the relations of our professors and teaching staff to this question we are faced by considerations which compel us to look very closely into our whole scheme of work in its true proportions and perspective. As we have seen, the duty which bulks most largely is that of providing an adequate technical or professional training for a large number of average young men. These large numbers cannot be adequately dealt with unless the teaching is organised and carried out on the most business-like lines. This practical side of the question naturally bulks largely in the minds of the heads of our colleges, and we need not, therefore, be surprised that one of the qualities in the teachers which is most appreciated is the capacity for businesslike organisation.

It is fortunate that the combination of these businesslike qualities with high attainments in science is not more rare than it is, so that in our colleges we do find brilliant examples of this combination. Where this is the case the problem of the creation of an atmosphere of inquiry and research is much simplified. It is only necessary that we should ensure, for the men who can use it, a sufficiency of leisure and opportunity for the prosecution of original work. It is to be desired, however, that there should be some recognised organisation within the college for so dealing with the distribution of the routine duties of teaching and examination that this leisure may be obtained in a normal and regular way.

The problem of creating the proper atmosphere becomes more difficult if the regular staff does not comprise within itself men who, by natural endowment and training, are fitted to inspire and to organise the work of a body of research students. So far as I know, few, if any, of our institutions are yet in a position to add to their staff and equipment solely with the object of fostering pioneer work. Yet it occurs to me that this is a direction in which we shall have to move ere long, and the sooner we begin to familiarise our governing bodies with the idea, the better it will be for all concerned.

Returning, however, to the case of those institutions which already have on their staff men with the necessary endowments, we may consider the further needs of the students, of those who have been selected for their special capabilities. While mere pecuniary inducements are in themselves the most unsatisfactory means for the stimulation of the right kind of original work, yet it must be recognised that pecuniary considerations are likely to bulk considerably in the minds of the majority of the students with whom we have to deal. It must be assumed, I think, that the pursuit of research work in any serious sense can only be taken up after the ordinary curriculum has been completed. This means that the selected students must continue their association with the college as research students. It would therefore be necessary to provide scholarships of sufficient value to compensate them for the postponement of their entry into the ranks of the paid workers in industry. In some institutions a beginning has already been made in this direction, and as these experiments grow in magnitude and success we look forward to a wider recognition of the benefit to all concerned.

On the financial side of this question I am tempted to detain you by a very brief digression. In seeking for financial help for schemes of this kind we may find it of advantage to disabuse the mind of the "generous donor" of the idea that the only way in which he can help is by endowing our schemes by large grants of capital. Endowments of this kind are invaluable in certain directions, but there are schemes of a more tentative kind for which all that is required is a guarantee of the expenditure for a very few years. For example, our first research student can start to work so soon as a donor can be found who will guarantee the income of the student for one, two, or three years. The donor might thus provide 100*l.* a year for three years at a total cost of 300*l.* Whereas,



if he were asked to endow a fellowship of this annual value he would immediately have to hand over 3000*l*. This method certainly lends itself admirably to the making of untried experiments in educational as well as in other matters. I do not speak altogether without practical experience of the method, and I have therefore ventured to make this digression in order to commend it to your attention.

It is of set purpose that I have discriminated sharply between the functions of the technical college; the training of large numbers of competent craftsmen or professional men, and the development of a smaller class of scientific pioneers. We must admit that the latter function is likely to make the less effective appeal to the general public; indeed, it would be surprising if it were to appeal to more than a select few. I take this to mean that within the managing body we must be satisfied to proceed cautiously in developing this function. There need be no doubt or hesitation as to the *objects* to be attained, but prudence and caution will be required in the application of the means at our disposal. *Men* are of far greater importance than *money*, and I confess to a certain distrust of schemes of scientific research which are splendid mainly because they are splendidly financed. No great research department can develop except by a process which is analogous to organic growth. If the right kind of nucleus can be placed in a suitable environment we may rest assured that nature will do the rest by her processes of cell division and multiplication. It is our part to see that the nucleus is sound and of the right kind, to provide for it the necessary environment, and to weed out all useless and undesirable growths.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. R. C. Punnett has been appointed superintendent of the museum of zoology in succession to Dr. S. F. Harmer, F.R.S., who recently accepted the keepership in zoology at the British Museum (Natural History).

The Smith's prizes have been adjudged as follows:—H. W. Turnbull, Trinity College, for his essay, "The Irreducible Concomitants of Two Quadratics in *n* Variables"; G. N. Watson, Trinity College, for his essay, "The Solution of the Homogeneous Linear Difference Equation of the Second Order, and its Applications to the Theory of Linear Differential Equations of Fuchsian Type." The names are in alphabetical order.

Dr. McIaggart has been appointed chairman of the examiners for the moral sciences tripos, and Mr. H. O. Meredith chairman of the examiners for the economics tripos.

Sir Victor Horsley has been appointed Linacre lecturer at St. John's College, Cambridge. The lecture will be delivered on Thursday, May 6, the subject being "The Motor Area of the Brain."

LONDON.—Mr. G. A. Schott has been granted the degree of D.Sc. in applied mathematics as an external student, and Mr. G. W. C. Kaye has been granted the degree of D.Sc. in physics as an external student.

The medical college of the London Hospital has recently received a sum of 20,000*l*., which has been placed in the hands of trustees. The yearly income will be spent on the advancement of medical research and the promotion of higher education in medicine. The donor wishes to remain anonymous.

The Senate has taken exception to the terms of reference to the Royal Commission on the University on the ground that the scope of the inquiry is wider than was approved by the Senate at their meeting in December, 1908, and that the Senate has not been given the opportunity to consider extended terms of reference.

OXFORD.—The following is the text of the speech delivered by Prof. Love in presenting Dr. Sven Hedin for the degree of D.Sc. *honoris causa* on March 2:—"Gaudet profecto et sibi gratulatur Academia nostra dum salutat eum qui sicut Ulixes πολλῶν ἀνθρώπων ἴδεν ἅπτα κτλ νόον ἔγνω, qui Marci Poli, Christopheri Columbi, Alexandri Humboldt æmulus inter insignissimos orbis terrarum

exploratores iure numerandus est. Quippe hic ille est Sven Hedin cuius itinera periculosa hodie in ore animoque omnium sunt. Civiles palmas non minus illustres esse quam bellicas aiunt: quod si verum sit, hunc virum tanquam victorem ornare possumus, cum de ipsa Natura faciem novercalem ostendente atque atrocissime minante victoriam reportaverit. Multas hic personas eadem laude gessit, modo exploratoris impavidi qui vel multis comitantibus vel solus secum deserta perlustrat, modo ducis benigni qui nudato pede calceis aqua repletis morientis calonis sitim levat, modo scientiæ cultoris qui labores tæterrimos perpressus regiones incognitas pedetemptim recludit. Quam diu ingentes Indiæ fluvii in Oceanum volventur, quam diu Asiæ interioris montes nivibus vestiti et aviæ solitudines manebunt, monumento hic vir non egebit."

M. DELAFOND will on July 1 next succeed M. E. Nivoit as director of the Paris National School of Mines.

THE London Inter-collegiate Scholarships Board will hold a combined examination for twenty entrance scholarships and exhibitions, tenable at University College, King's College, and the East London College, on May 11 and following days. No candidates will be admitted to the examination unless they have passed the London University matriculation or an equivalent examination, and are under the age of nineteen on May 1. The total value of scholarships offered is about 1500*l*. Full particulars and forms of entry may be obtained from the secretary of the board, Mr. Alfred E. G. Attoe, University College, Gower Street, W.C.

ANNOUNCEMENTS have been made in the Press that the Aërial League of the British Empire purposes to establish immediately a national aeronautical college. It is intended that the new college shall provide instruction in the subjects bearing upon aërial flight and navigation. Courses of study will be arranged in the mathematics, dynamics, and mechanics involved in the problem of flight, the laws of air resistance and friction, the stability of air craft, and in the meteorological, physical, and other conditions affecting aërial navigation. Workshops and laboratories, where experiments and tests can be performed, are to be included in the college, and a trial ground is to be procured. The intention is to teach completely the science and art of flying. It is satisfactory to find that the promoters of the scheme appreciate the necessity for founding practice upon scientific knowledge, and it may be hoped that the experiments to be performed will be based upon exhaustive theoretical inquiries into the mathematical principles which underlie the problems it is sought to solve by practical means.

THE annual report on the work of University College, London, shows that the total number of students during the session 1907-8 was 1361, being an increase of 170 on that of the preceding session. Of these, 229 were post-graduate and research students. The principal benefactions during the year were a bequest of 5000*l*. by the late Mr. Thomas Webb, of London and Cardiff, which is to be used for the completion of the new physiology building; a bequest of 500*l*. by Mr. H. A. Kay, to be used for the re-arrangement and re-equipment of the college buildings; a bequest of 1000*l*. by the late Prof. Bunnell Lewis; a bequest of 1541*l*. by the late Madame Halfon, for the foundation of prizes to be known as the "L. M. Rothschild" and the "Hester Rothschild" prizes; a gift by the past engineering students' committee of 410*l*., for the new equipment of the engineering departments; and a donation of 50*l*. by Mr. Yarrow, for the provision of apparatus in the mechanical engineering department. Besides the grants from the Treasury, the India Office, and the London County Council, the college benefited during the past year by grants from the Carpenters' Company for architecture, from the Chadwick trustees for municipal engineering and hygiene, from the Drapers' Company for applied mathematics, and from the Mercers' Company for physiology. Rapid progress has been made with the new buildings for the department of physiology, which will be ready for occupation next month. The re-arrangement and re-equipment of the college buildings involved an expenditure of 5988*l*. In order to assist the deans in the two most complex faculties, those of arts